DPB01CM44 - PPB01CM44

True RMS 3-Phase voltage monitoring relay

Benefits

- **Wide input voltage range and frequency.** Very wide input voltage range: from 208Vac to 480Vac ±15% (177Vac to 552Vac), up to 400Hz mains.
- **Adjustable voltage ranges and over / under.** 8 voltage ranges can be selected by front DIP Switches. Over and under voltages are adjustable from + or - 2 to 22% of the selected range.
- **Switch mode power supply.** Very low consumption, heat and dissipation. Control circuit power supply is filtered and therefore immune to mains disturbances, noise and harmonics.
- **Output LED indication.** A yellow LED provides visual indication of the output status.
- **Relay contact output.** A relay contact provides electrical (remote) indication of the alarms/output status.
- **Enclosure versatility.** DPB01 features 22.5mm standard DIN enclosure. PPB01 is the Plug-In version, suitable for Undecal socket.

Description

xPB01CM44 relays are threephase mains monitoring devices.
They can operate on both 3Ph and 3Ph+N mains detecting, besides the phase loss and the correct phase sequence, possible overvoltages and undervoltages.
Power supply is provided by the monitored mains, is wide input range and switch mode.
Consumption, dissipation and consequently heat are very limited.
A delay on alarm, up to 30s, for the over/under voltage alarms, filters unwanted trippings for temporary conditions.
Operating frequency is up to 400Hz.

Applications

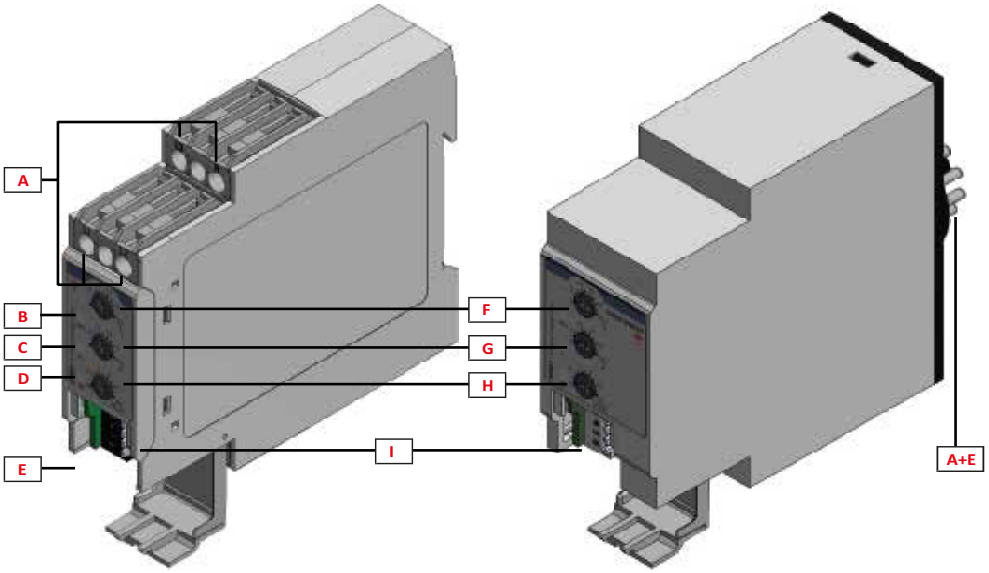
DPB/PPB01CM44 are suitable for applications where it is necessary to monitor, besides the phase presence and correct phase sequence of threephase mains, also the correct supply voltage value: lifts, escalators, HVAC, material handling, pumps and compressors, mobile machinery, for places with unstable mains or for export markets, airport and aircraft applications due to 400Hz max. operating frequency.

Main functions

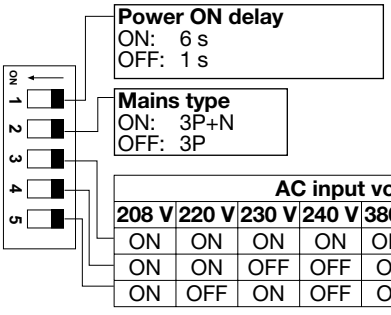
- 3Ph or 3Ph+N monitoring
- From 208V to 480V @50 to 400Hz, nominal voltage and frequency
- Adjustable over / under voltage and delay on alarm

- Phase sequence and phase loss alarm
- 8A SPDT relay output

Structure



Element	Component	Function
A	Input/supply terminals	DIN rail mounting: L1, L2, L3 and N (when necessary), double cage clamp terminals Plug-in mounting: 5, 6, 7, 11
B	Output status LED	Yellow, ON when output active (No Alarm)
C	Alarm LED "AL"	5Hz RED flashes during phase loss, wrong phase sequence. Blinking slow (2Hz) when over / under voltage is triggered but delay is elapsing, RED steady ON when delay elapsed.
D	Power ON LED	GREEN, lit when device supplied on at least two input lines
E	Output terminals	Output relay contacts terminals DPB01: 15 COM, 16 NC*, 18 NO* PPB01: 1COM, 4 NC*, 3 NO* * when power supply not applied.
F	Undervoltage setting	Undervoltage setting dial, range from -2% to -22% of rated mains voltage
G	Overvoltage setting	Overvoltage setting dial, range from +2% to +22% of rated mains voltage
H	Delay on alarm	Delay on alarm setting dial. Delay from 0.1s to 30s
I	DIP switches	See fig. 1 (DIP switch settings table)



Power ON delay
ON: 6 s
OFF: 1 s

Mains type
ON: 3P+N
OFF: 3P

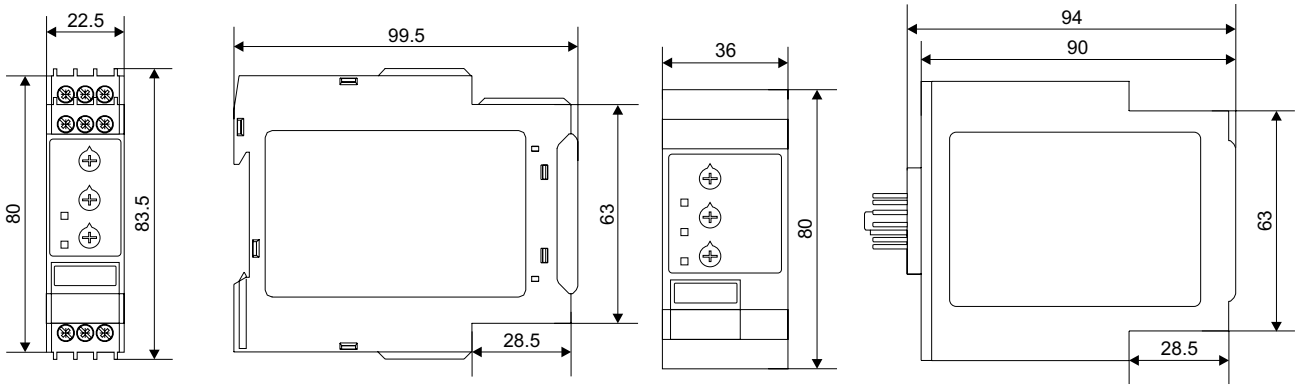
AC input voltage							
208 V	**220 V**	**230 V**	**240 V**	**380 V**	**400 V**	**415 V**	**480 V**
ON	ON	ON	ON	OFF	OFF	OFF	OFF
ON	ON	OFF	OFF	ON	ON	OFF	OFF
ON	OFF	ON	OFF	ON	OFF	ON	OFF

Fig. 1 *DIP switch settings table*

Features

General

Material	PA66 or Noryl
Colour	RAL7035 (light grey)
Dimensions d x h x w	DPB01: 99.5mm x 80mm x 22.5mm (3.92" x 3.15" x 0.886") PPB01: 94mm x 80mm x 36mm (3.7" x 3.15" x 1.42")
Protection degree	IP20
Weight	150 g (5.29oz)
Terminals	Cable size from 0.05mm² to 2.5mm² (AWG30 to AWG13), stranded or solid
Tightening torque	Max. 0.5Nm (4.425lb.in)
Terminal type	Double cage screw terminals (DPB01), Undecal Plug-in terminals (PPB01)



Power supply

Power supply	Voltage range: 208Vac to 480Vac ±15% (177V to 552V) Supplied from measured phases Frequency range: 50Hz to 400Hz ±10% sinusoidal waveform
Consumption	< 2.5 VA
Supply technology	Switch mode supply from all 3 phases

Environmental

Working temperature	-20° C to 60° C (-4° F to 140° F)
Storage temperature	-30° C to 80° C (-22° F to 176° F)
Relative humidity	5-95% non condensing
Pollution degree	2
Operating max altitude	2000 m amsl (6560ft)
Salinity	No saline environment
UV resistance	No

Vibration/Shock resistance

Test condition	Test	Level
Tests with unpacked device	Vibration response (IEC60255-21-1)	Class 1
	Vibration endurance (IEC 60255-21-1)	Class 1
	Shock (IEC 60255-21-2)	Class 1
	Bump (IEC 60255-21-2)	Class 1
Tests with packed device	Vibration random (IEC60068-2-64)	Class 1
	Shock (IEC 60255-21-2)	Class 1
	Bump (IEC 60255-21-2)	Class 1

Class 1: Monitoring devices for normal use in power plants, substations and industrial plants and for normal transportation conditions.
The packaging type is designed and implemented in such manner that the severity class parameters will not be exceeded during transportation.

Compatibility and conformity

CE-marking	According to EN 60947-5-1. Complies to European LV directive 2014/35/EU and EMC directive 2014/30/EU: Immunity according to EN61000-6-2; Emissions according to EN61000-6-3
Approvals	c UL us LISTED UL508, CSA Standard C22.2

Inputs

Measuring ranges	
Measured variables	Voltage PH-PH measurement on L1, L2 and L3 lines Phase sequence Phase loss

Voltage measurement	
Typology	PH-PH voltage measurement on L1, L2 and L3 lines
Nominal line range	From 208Vac to 480Vac ±15%
Setting ranges (Un)	208V, 220V, 230V, 240V, 380V, 400, 415, 480V

Over / under voltage alarms	
Input variables	Voltage measurements L1-L2, L2-L3, L1-L3
Reaction time	≤ 200ms + set delay ON alarm
Undervoltage setting range (U<)	From -2% to -22%
Overvoltage setting range (U>)	From 2% to 22%
Resolution	1V + 2% notch
Accuracy	1V + 2%
Repeatability	0.5% reading
Hysteresis	Setpoint between 2% and 5% = Hys 1% Setpoint between 5% and 22% = Hys 2%
Delay ON	Adjustable from 0.1s to 30s Accuracy: absolute form ±50ms at 0.1s to ±5s at 30s Repeatability: absolute form ±10ms at 0.1s to ±1 at 30s
Delay OFF	None

Phase loss alarm	
Input variables	Voltage measurements L1-L2, L2-L3 and L1-L3
Alarm Threshold	≤70% of the least one compared to rated value
Restore threshold	>70% of least phase compared to rated value + Hysteresis
Reaction time	≤ 200 ms
Hysteresis	2% fixed
Delay ON	None
Delay OFF	None

Phase sequence alarm	
Input variables	Connection L1, L2, L3
Reaction time	≤ 200 ms
Adjustable range	Not applicable, always active
Delay ON	None
Delay OFF	None

Outputs

Number of outputs	1
Type	SPDT electromechanical relay with change-over contacts
Logic	Output de-energized on alarm
Contact rating	**AC1**: 8 A @ 250 VAC **AC15**: 2.5 A @ 250 VAC **DC12**: 5 A @ 24 VDC **DC13**: 2.5 A @ 24 VDC
Electrical lifetime	10^5 operations
Mechanical lifetime	>30 x 10^6 operations
Assignment	Associated to all alarm types

Insulation

Terminals	Basic insulation
Inputs: L1,L2,L3,N to Output : 11,12,14	2.5KVrms, 4KV impulse 1.2/50us (basic)

Operating Description

- **Suitability**

DPB/PPB01CM44 can be used for power supply and mains quality monitoring of all threephase loads, with or without neutral, supply voltage from 208VAC to 480VAC and frequencies from 50 to 400Hz.

- **Device configuration**

The relay operates when all the phases are present, the phase sequence is correct and the phase-phase voltage levels are within set limits.
The relay releases when one or more phase-phase voltages exceeds the upper set level or drops below the lower set level.
The DPB/PPB01CM44 is configurable by trimmers, in order to set Over / Under Voltage, Delay ON.

Undervoltage adjustment dial	
Typology	Linear selection from -2% to -22%
Resolution	2% / notch
Function	Relative voltage threshold setting of UNDERVOLTAGE alarm

Overvoltage adjustment dial	
Typology	Linear selection from +2% to +22%
Resolution	2% / notch
Function	Relative voltage threshold setting of OVERVOLTAGE alarm

Delay setting dial	
Typology	Logarithmic adjustment from 0.1s to 30s
Resolution	From 100ms/notch at 0.1s to 10s/notch at 30s
Function	Alarm ON Delay setting for undervoltage and overvoltage

DIP switches	
Typology	6 switches DIP Switch (switch number 6 is unused)
Function	- Power ON delay - Grid type - Grid voltage (8 ranges)

- **Alarms**

The DPB/PPB01CM44 operates in 2 different modes depending upon the alarm type:
- Phase loss and wrong phase sequence cause immediate (only <200ms delay occur due to device reaction time) output relay de-energisation, yellow LED turns OFF at the same time. Red "AL" flashes fast to display this type of alarm.
- Under or over voltage triggering cause output relay and yellow LED to turn OFF at the end of set delay. During the delay elapsing the red "AL" LED blinks slowly and turn steady ON at the end of delay.

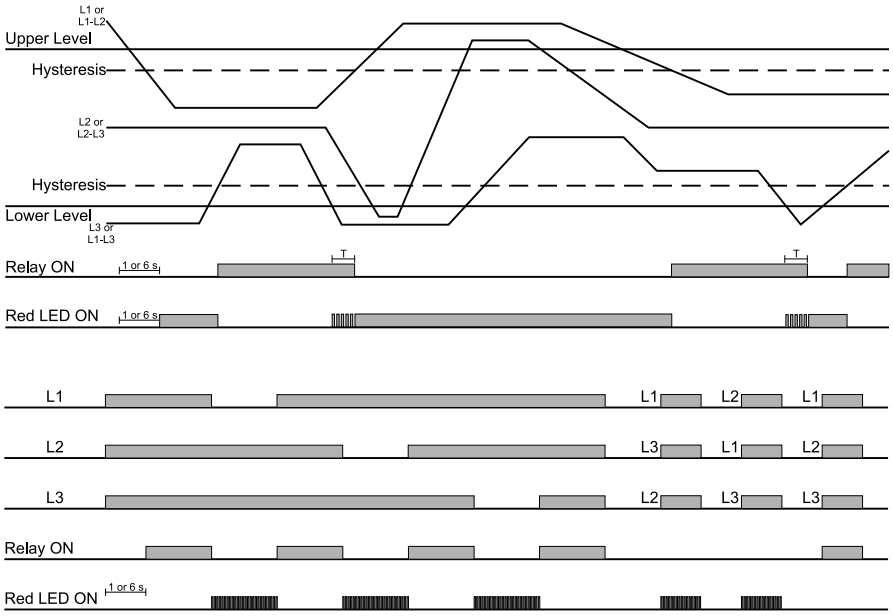
- **Visual information**

DPB/PPB01CM44 feature 3 front LEDs which provide operation status information.
- LED 1, green, is ON when the power supply is applied.
- LED 2 "AL" provides Alarm Status information: When an over or under voltage alarm is triggered, but there is a delay on alarm elapsing, the LED blinks Red at 2Hz during the delay then, if alarm situation still present at the end of delay, it turns steady ON.
If a phase is lost, the phase sequence is wrong and the LED flashes fast at 5Hz.
- LED 3, yellow, is ON when the output relay is energised.

- **Phase loss**

Phase loss measurement is performed by comparing the 3 phases voltages (L1-L2, L2-L3, L3-L1) or phase to neutral (L1-N, L2-N, L3-N) on star grid type. If the voltage of one phase falls below 70% compared to the other 2 phases, the alarm goes off. DPB/PPB01CM44 detects loads regenerated voltage, for instance on motor or transformer loads.

Operating diagram



Connection Diagrams

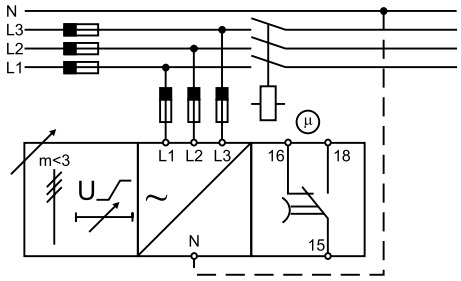


Fig. 2 *DPB01 - Example 1*

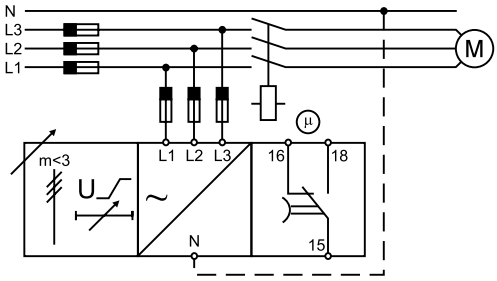


Fig. 3 *DPB01 - Example 2*

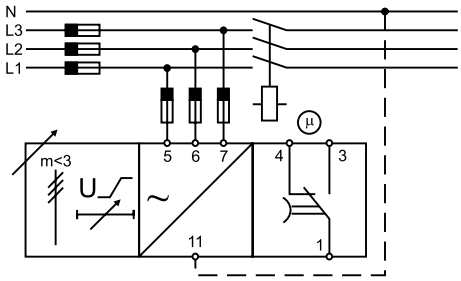


Fig. 4 *PPB01 - Example 1*

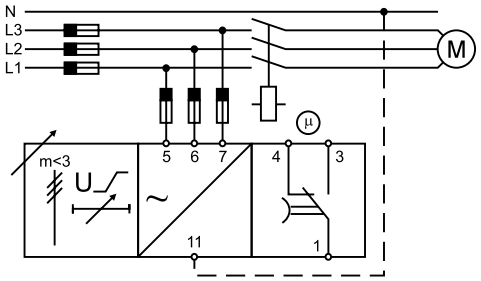


Fig. 5 *PPB01 - Example 2*

References

Order code

□PB01CM44

Complete the code entering the corresponding option instead of □

Code	Option	Description
□	D	DIN rail mounting housing
	P	Plug-in housing
P	-	Function
B	-	Type
01	-	Item number
C	-	Output
M44	-	Power supply

DPB02CM44 - PPB02CM44

True RMS 3-Phase voltage monitoring relay

Benefits

- **Wide input voltage range and frequency.** Very wide input voltage range: from 208Vac to 480Vac ±15% (177Vac to 552Vac), up to 400Hz mains.
- **Adjustable voltage ranges and asymmetry level.** 8 voltage ranges can be selected by front DIP Switches. Asymmetry trip level can be adjusted from 2% to 22%.
- **Switch mode power supply.** Very low consumption, heat and dissipation. Control circuit power supply is filtered and therefore immune to mains disturbances, noise and harmonics.
- **Output LED indication.** A yellow LED provides visual indication of the output status.
- **Relay contact output.** A relay contact provides electrical (remote) indication of the alarms/output status.
- **Enclosure versatility.** DPB02 features 22.5mm standard DIN enclosure. PPB02 is the Plug-In version, suitable for Undecal socket.

Description

xPB02CM44 relays are threephase mains monitoring devices.
They can operate on both 3Ph and 3Ph+N mains detecting, besides the phase loss and the correct phase sequence, possible phase values asymmetries.
Power supply is provided by the monitored mains, is wide input range and switch mode.
Consumption, dissipation and consequently heat are very limited.
A delay on alarm, up to 30s, for asymmetry alarm, filters unwanted trippings for temporary conditions.
Operating frequency is up to 400Hz.

Applications

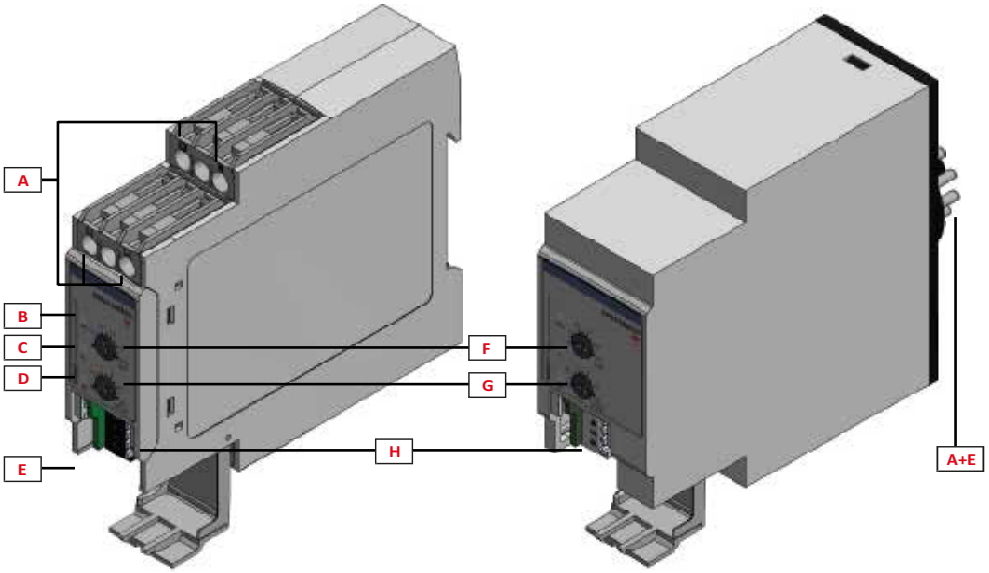
DPB/PPB02CM44 are suitable for applications where it is necessary to monitor, besides the phase presence and correct phase sequence of threephase mains, also that the difference of the three phases voltages is within a certain limit. Motors lifetime is significatly shortened by high supply asymmetry values. Applications such as HVAC, pumping and compressors will benefit. This device can also be used in airport and aircraft applications due to 400Hz max. operating frequency.

Main functions

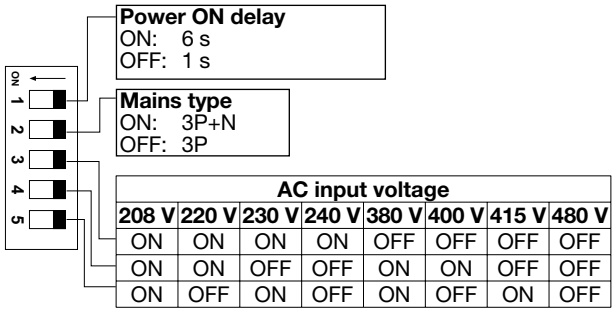
- 3Ph or 3Ph+N monitoring
- From 208V to 480V @50 to 400Hz, nominal voltage and frequency
- Adjustable asymmetry and delay on alarm

- Phase sequence and phase loss alarm
- 8A SPDT relay output

Structure



Element	Component	Function
A	Input/supply terminals	DIN rail mounting: L1, L2, L3 and N (when necessary), double cage clamp terminals Plug-in mounting: 5, 6, 7, 11
B	Output status LED	Yellow, ON when output active (No Alarm)
C	Alarm LED "AL"	5Hz RED flashes during phase loss, wrong phase sequence. Blinking slow (2Hz) when asymmetry is triggered but delay is elapsing, RED steady ON when delay elapsed.
D	Power ON LED	GREEN, lit when device supplied on at least two input lines
E	Output terminals	Output relay contacts terminals DPB02: 15 COM, 16, NC*, 18 NO* PPB02: 1COM, 4 NC*, 3 NO* * when power supply not applied.
F	Asymmetry setting	Asymmetry setting dial, range from 2% to 22%
G	Delay on alarm	Delay on alarm setting dial. Delay from 0.1s to 30s
H	DIP switches	See fig. 1 (DIP switch settings table)



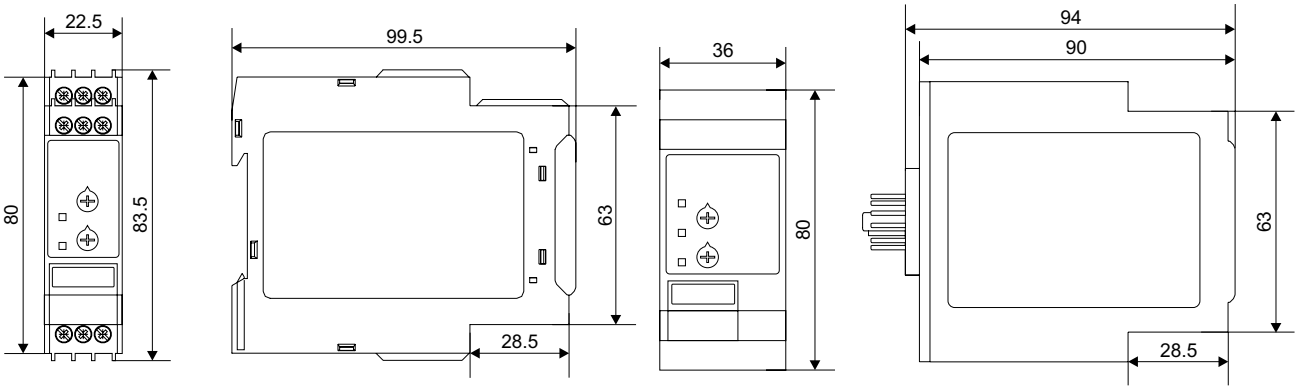
AC input voltage							
208 V	**220 V**	**230 V**	**240 V**	**380 V**	**400 V**	**415 V**	**480 V**
ON	ON	ON	ON	OFF	OFF	OFF	OFF
ON	ON	OFF	OFF	ON	ON	OFF	OFF
ON	OFF	ON	OFF	ON	OFF	ON	OFF

Fig. 1 *DIP switch settings table*

Features

General

Material	PA66 or Noryl
Colour	RAL7035 (light grey)
Dimensions d x h x w	DPB02: 99.5mm x 80mm x 22.5mm (3.92" x 3.15" x 0.886") PPB02: 94mm x 80mm x 36mm (3.7" x 3.15" x 1.42")
Protection degree	IP20
Weight	150 g (5.29oz)
Terminals	Cable size from 0.05mm² to 2.5mm² (AWG30 to AWG13), stranded or solid
Tightening torque	Max. 0.5Nm (4.425lb.in)
Terminal type	Double cage screw terminals (DPB02), Undecal Plug-in terminals (PPB02)



Power supply

Power supply	Voltage range: 208Vac to 480Vac ±15% (177V to 552V) Supplied from measured phases Frequency range: 50Hz to 400Hz ±10% sinusoidal waveform
Consumption	< 2.5 VA
Supply technology	Switch mode supply from all 3 phases
Power-ON delay	Alarms are inhibited for the set time at power ON

Environmental

Working temperature	-20° C to 60° C (-4° F to 140° F)
Storage temperature	-30° C to 80° C (-22° F to 176° F)
Relative humidity	5-95% non condensing
Pollution degree	2
Operating max altitude	2000 m amsl (6560ft)
Salinity	No saline environment
UV resistance	No

Vibration/Shock resistance

Test condition	Test	Level
Tests with unpacked device	Vibration response (IEC60255-21-1)	Class 1
	Vibration endurance (IEC 60255-21-1)	Class 1
	Shock (IEC 60255-21-2)	Class 1
	Bump (IEC 60255-21-2)	Class 1
Tests with packed device	Vibration random (IEC60068-2-64)	Class 1
	Shock (IEC 60255-21-2)	Class 1
	Bump (IEC 60255-21-2)	Class 1

Class 1: Monitoring devices for normal use in power plants, substations and industrial plants and for normal transportation conditions.
The packaging type is designed and implemented in such manner that the severity class parameters will not be exceeded during transportation.

Compatibility and conformity

CE-marking	According to EN 60947-5-1. Complies to European LV directive 2014/35/EU and EMC directive 2014/30/EU: Immunity according to EN61000-6-2; Emissions according to EN61000-6-3
Approvals	c UL us LISTED UL508, CSA Standard C22.2

Inputs

Measuring ranges	
Measured variables	Voltage PH-PH measurement on L1, L2 and L3 lines Phase sequence Phase loss

Voltage measurement	
Typology	PH-PH voltage measurement on L1, L2 and L3 lines
Nominal line range	From 208Vac to 480Vac ±15%
Setting ranges (Un)	208V, 220V, 230V, 240V, 380V, 400, 415, 480V

Asymmetry alarm	
Input variables	Voltage measurements L1-L2, L2-L3, L1-L3
Reaction time	≤ 200ms + set delay ON alarm
Asymmetry setting range	from 2% to 22%
Repeatability	0.5% reading
Hysteresis	Setpoint between 2% and 5% = Hys 1% Setpoint between 5% and 22% = Hys 2%
Delay ON	Adjustable from 0.1s to 30s Accuracy: absolute form ±50ms at 0.1s to ±5s at 30s Repeatability: absolute form ±10ms at 0.1s to ±1 at 30s
Delay OFF	None

Phase loss alarm	
Input variables	Voltage measurements L1-L2, L2-L3 and L1-L3
Alarm Threshold	≤70% of the least one compared to rated value
Restore threshold	>70% of least phase compared to rated value + Hysteresis
Reaction time	≤ 200 ms
Hysteresis	2% fixed
Delay ON	None
Delay OFF	None

Phase sequence alarm	
Input variables	Connection L1, L2, L3
Reaction time	≤ 200 ms
Adjustable range	Not applicable, always active
Delay ON	None
Delay OFF	None

Outputs

Number of outputs	1
Type	SPDT electromechanical relay with change-over contacts
Logic	Output de-energized on alarm
Contact rating	**AC1**: 8 A @ 250 VAC **AC15**: 2.5 A @ 250 VAC **DC12**: 5 A @ 24 VDC **DC13**: 2.5 A @ 24 VDC
Electrical lifetime	10^5 operations
Mechanical lifetime	>30 x 10^6 operations
Assignment	Associated to all alarm types

Insulation

Terminals	Basic insulation
Inputs: L1,L2,L3,N to Output : 11,12,14	2.5KVrms, 4KV impulse 1.2/50us (basic)

Operating Description

- **Suitability**

DPB/PPB02CM44 can be used for power supply and mains quality monitoring of threephase motors, or other loads that require balanced threephase voltage, with or without neutral, supply voltage from 208VAC to 480VAC and frequencies from 50 to 400Hz.

- **Device configuration**

The relay operates when all the phases are present, the phase sequence is correct and the asymmetry is below the set limit.
The relay releases when alarm goes off.
An asymmetry alarm is triggered when the voltage difference, in percentage, between highest phase value and the lowest one exceeds the set asymmetry level.
The DPB/PPB02CM44 is configurable by trimmers, in order to set asymmetry level and delay on alarm.

Asymmetry adjustment dial	
Typology	Linear selection from +2% to +22%
Resolution	2% / notch
Function	Asymmetry percentage threshold setting alarm

Delay setting dial	
Typology	Logarithmic adjustment from 0.1s to 30s
Resolution	From 100ms/notch at 0.1s to 10s/notch at 30s
Function	Alarm ON Delay setting for asymmetry

DIP switches	
Typology	6 switches DIP Switch (switch number 6 is unused)
Function	- Power ON delay - Grid type - Grid voltage (8 ranges)

- **Alarms**

The DPB/PPB02CM44 operates in 2 different modes depending upon the alarm type:
- Phase loss and wrong phase sequence cause immediate (only <200ms delay occur due to device reaction time) output relay de-energisation, yellow LED turns OFF at the same time. Red "AL" flashes fast to display this type of alarm.
- Asymmetry triggering cause output relay and yellow LED to turn OFF at the end of set delay. During the delay elapsing the red "AL" LED blinks slowly and turn steady ON at the end of delay.

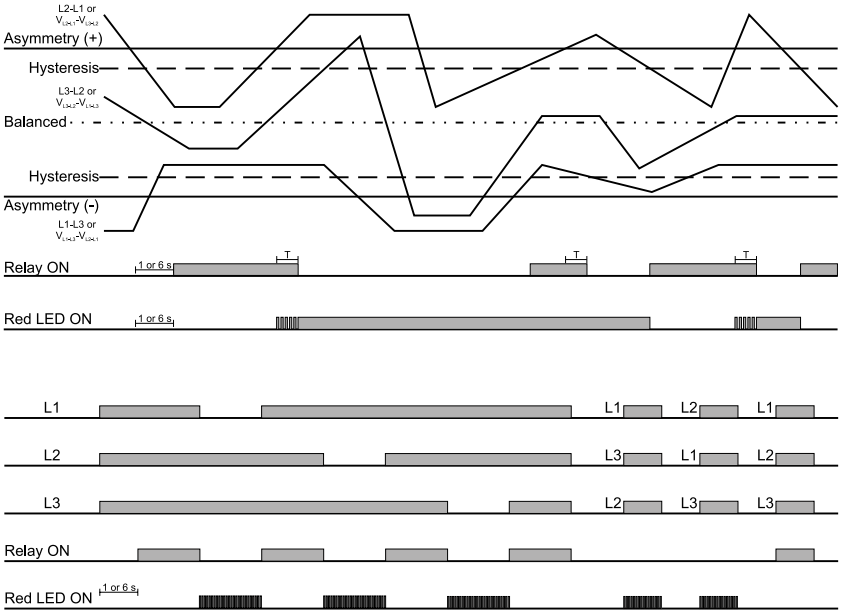
- **Visual information**

DPB/PPB02CM44 feature 3 front LEDs which provide operation status information.
- LED 1, green, is ON when the power supply is applied.
- LED 2 "AL" provides Alarm Status information: when an asymmetry alarm is triggered, but there is a delay on alarm elapsing, the LED blinks Red at 2Hz during the delay then, if alarm situation still present at the end of delay, it turns steady ON.
If a phase is lost, the phase sequence is wrong and the LED flashes fast at 5Hz.
- LED 3, yellow, is ON when the output relay is energised.

- **Phase loss**

Phase loss measurement is performed by comparing the 3 phases voltages (L1-L2, L2-L3, L3-L1) or phase to neutral (L1-N, L2-N, L3-N) on star grid type. If the voltage of one phase falls below 70% compared to the other 2 phases, the alarm goes off. DPB/PPB02CM44 detects loads regenerated voltage, for instance on motor or transformer loads.

Operating diagram



Connection Diagrams

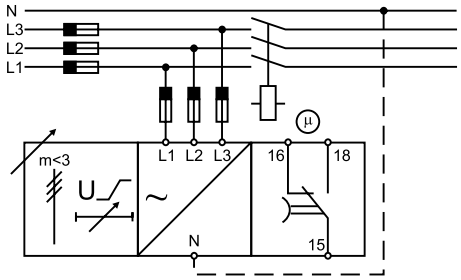


Fig. 2 *DPB02 - Example 1*

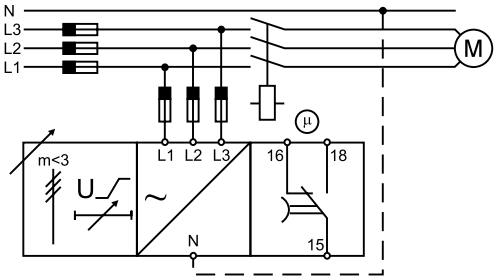


Fig. 3 *DPB02 - Example 2*

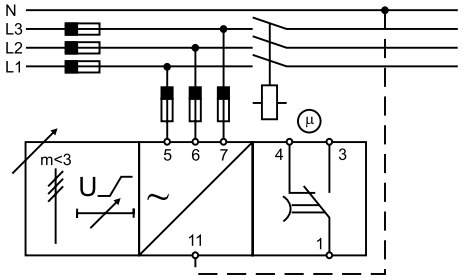


Fig. 4 *PPB02 - Example 1*

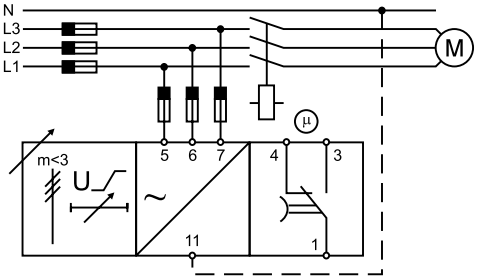


Fig. 5 *PPB02 - Example 2*

References

Order code

☐PB02CM44

Complete the code entering the corresponding option instead of ☐

Code	Option	Description
☐	D	DIN rail mounting housing
	P	Plug-in housing
P	-	Function
B	-	Type
02	-	Item number
C	-	Output
M44	-	Power supply

DPC01DM44

True RMS 3-Phase voltage monitoring relay

Benefits

- **Widest input voltage range and frequency.** Very wide input voltage range: from 208Vac to 690Vac ±15% (177Vac to 793Vac), up to 400Hz mains.
- **Adjustable voltage ranges.** 11 voltage ranges can be selected by front DIP Switches.
- **Asymmetry/tolerance or under/over voltage**. The function can be selected between asymmetry/tolerance or over/under voltage.
- **Switch mode power supply.** Very low consumption, heat and dissipation. Control circuit power supply is filtered and therefore immune to mains disturbances, noise and harmonics.
- **Output LED indication.** One LED each output provides output status information.
- **2 relay contact outputs.** Two relay outputs provide electrical (remote) indication of the alarms/output status.
- **2 delays on alarm**. Two independent alarms for asymmetry/tolerance or under/over voltage.

Description

DPC01DM44 relay is a multifunction threephase mains monitoring device.
It can operate on both 3Ph and 3Ph+N mains detecting, besides the phase loss and the correct phase sequence, possible overvoltages and undervoltages or asymmetry and tolerance excess.
Power supply is provided by the monitored mains, is wide input range and switch mode.
Consumption, dissipation and consequently heat are very limited.
It is certified for Marine applications and it operates up to 400Hz of mains frequency.

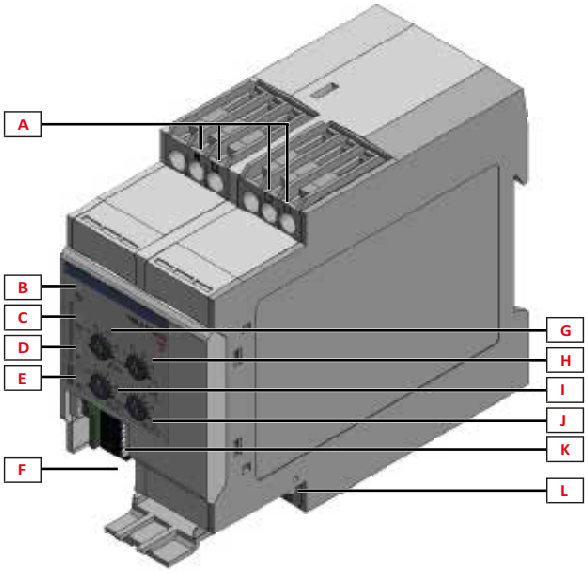
Applications

DPC01DM44 is suitable for applications where it is necessary to monitor, besides the phase presence and correct phase sequence of threephase mains, also the correct supply voltage or symmetry between phases: lifts, escalators, HVAC, material handling, pumps and compressors, mobile machinery, for places with unstable mains or for export markets, installation on vessels, airport and aircraft applications thanks to the Marine approval and 400Hz max. operating frequency.

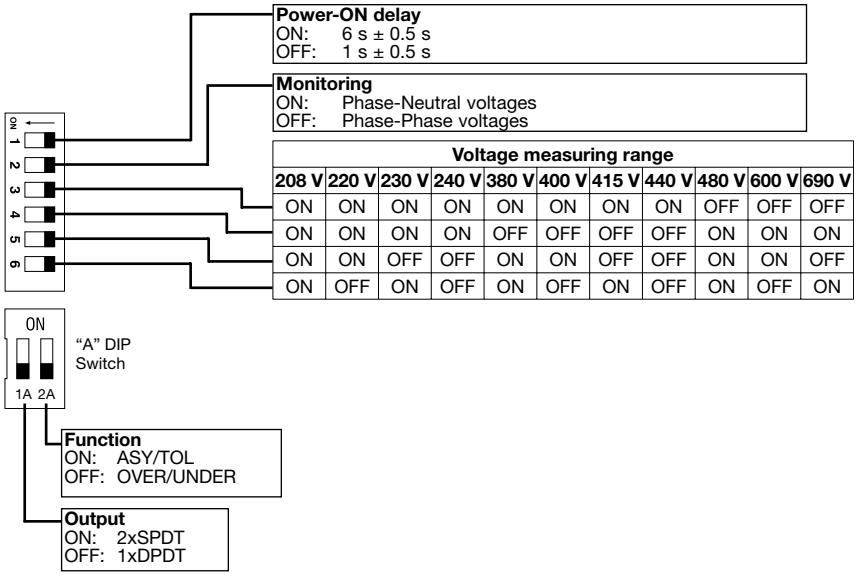
Main functions

- 3Ph or 3Ph+N monitoring
- From 208V to 690V @50 to 400Hz, nominal voltage and frequency
- Over / under voltage or tolerance/asymmetry
- Phase sequence and phase loss alarm
- 2 x 8A SPDT relay outputs

Structure



Element	Component	Function
A	Input/supply terminals	L1, L2, L3 and N (when necessary), double cage clamp terminals
B	Output status LED (2)	Yellow, ON when output 2 active (No Alarm)
C	Output status LED (1)	Yellow, ON when output 1 active (No Alarm)
D	Alarm LED "AL"	5Hz Red flashes during phase loss, wrong phase sequence. Blinking slow (2Hz) when over / under voltage is triggered but delay is elapsing, RED steady ON when delay elapsed.
E	Power ON LED	Green, lit when device supplied on at least two input lines
F	Output terminals (1)	Output 1 relay contacts terminals 15 COM, 16 NC*, 18 NO* * when power supply not applied.
G	Alarm 1: Overvoltage / Asymmetry setting	Depending upon setting: - Overvoltage setting dial - Asymmetry setting dial
H	Alarm 2: Undervoltage / Tolerance setting	Depending upon setting: - Undervoltage setting dial - Tolerance setting dial
I	Delay on alarm 1	Delay on alarm 1 setting dial. Delay from 0.1s to 30s
J	Delay on alarm 2	Delay on alarm 2 setting dial. Delay from 0.1s to 30s
K	DIP switches	See fig. 1 (DIP switch settings table)
L	Output terminals (2)	Output 2 relay contacts terminals 25 COM, 26 NC*, 28 NO* * when power supply not applied.



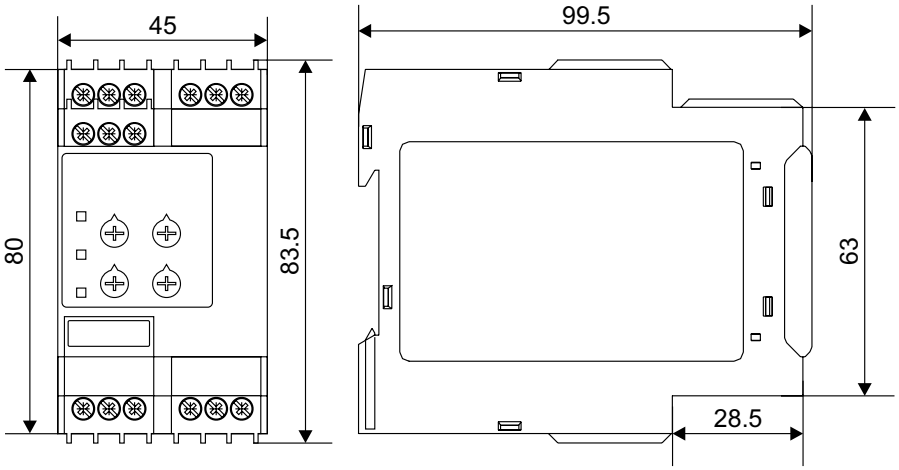
Voltage measuring range										
208 V	220 V	230 V	240 V	380 V	400 V	415 V	440 V	480 V	600 V	690 V
ON	ON	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF
ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON
ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF
ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON

Fig. 1 *DIP switch settings table*

Features

General

Material	PA66 or Noryl
Colour	RAL7035 (light grey)
Dimensions d x h x w	99.5mm x 80mm x 45mm (3.92" x 3.15" x 1.77")
Protection degree	IP20
Weight	220 g (7.76oz)
Terminals	Cable size from 0.05mm² to 2.5mm² (AWG30 to AWG13), stranded or solid
Tightening torque	Max. 0.5Nm (4.425lb.in)
Terminal type	Double cage screw terminals



Power supply

Power supply	Voltage range: 208Vac to 690Vac ±15% (177V to 793V) Supplied from measured phases Frequency range: 50Hz to 400Hz ±10% sinusoidal waveform
Consumption	< 4.5 VA
Supply technology	Switch mode supply from all 3 phases

Environmental

Working temperature	-20° C to 60° C (-4° F to 140° F)
Storage temperature	-30° C to 80° C (-22° F to 176° F)
Relative humidity	5-95% non condensing
Pollution degree	2
Operating max altitude	2000 m amsl (6560ft)
Salinity	No saline environment
UV resistance	No

Vibration/Shock resistance

Test condition	Test	Level
Tests with unpacked device	Vibration response (IEC60255-21-1)	Class 1
	Vibration endurance (IEC 60255-21-1)	Class 1
	Shock (IEC 60255-21-2)	Class 1
	Bump (IEC 60255-21-2)	Class 1
Tests with packed device	Vibration random (IEC60068-2-64)	Class 1
	Shock (IEC 60255-21-2)	Class 1
	Bump (IEC 60255-21-2)	Class 1

Class 1: Monitoring devices for normal use in power plants, substations and industrial plants and for normal transportation conditions.
The packaging type is designed and implemented in such manner that the severity class parameters will not be exceeded during transportation.

Compatibility and conformity

CE-marking	According to EN 60947-5-1. Complies to European LV directive 2014/35/EU and EMC directive 2014/30/EU: Immunity according to EN61000-6-2; Emissions according to EN61000-6-3
Approvals	c UL us LISTED UL508, CSA Standard C22.2 , RINA

Inputs

Measuring ranges	
Measured variables	Voltage PH-PH measurement on L1, L2 and L3 lines Phase sequence Phase loss

Voltage measurement	
Typology	PH-PH voltage measurement on L1, L2 and L3 lines
Nominal line range	From 208Vac to 690Vac ±15%
Setting ranges (Un)	208V, 220V, 230V, 240V, 380V, 400V, 415V, 440V, 480V, 600V, 690V

Over / under voltage alarms	
Input variables	Voltage measurements L1-L2, L2-L3, L1-L3 or L1-N, L2-N, L3-N when star mains is selected
Reaction time	≤ 200ms + set delay on Alarm
Undervoltage setting range (U<)	From -2% to -22%
Overvoltage setting range (U>)	From 2% to 22%
Resolution	1V + 2% notch
Accuracy	1V + 2%
Repeatability	0.5% reading
Hysteresis	Setpoint between 2% and 5% = Hys 1% Setpoint between 5% and 22% = Hys 2%
Delay ON	Adjustable from 0.1s to 30s Accuracy: absolute form ±50ms at 0.1s to ±5s at 30s Repeatability: absolute form ±10ms at 0.1s to ±1 at 30s
Delay OFF	None

Phase loss alarm	
Input variables	Voltage measurements L1-L2, L2-L3, L1-L3 or L1-N, L2-N, L3-N when star mains is selected
Alarm Threshold	≤70% of the least one compared to rated value
Restore threshold	>70% of least phase compared to rated value + Hysteresis
Reaction time	≤ 200 ms
Hysteresis	2% fixed
Delay ON	None
Delay OFF	None

Phase sequence alarm	
Input variables	Connection L1, L2, L3
Reaction time	≤ 200 ms
Adjustable range	Not applicable, always active
Delay ON	None
Delay OFF	None

Outputs

Number of outputs	2
Type	SPDT electromechanical relay with change-over contacts
Logic	Output de-energized on alarm
Contact rating	**AC1**: 8 A @ 250 VAC **AC15**: 2.5 A @ 250 VAC **DC12**: 5 A @ 24 VDC **DC13**: 2.5 A @ 24 VDC
Electrical lifetime	10^5 operations
Mechanical lifetime	>30 x 10^6 operations
Assignment	According to DIP 2A setting: Output 1: overvoltage or asymmetry Output 2: undervoltage or tolerance

Insulation

Terminals	Basic insulation
Inputs: L1,L2,L3,N to Output : 11,12,14	≥ 2kVac (rms), 4KV impulse 1.2/50us (basic)

Operating Description

- **Suitability**

DPC01DM44 can be used for power supply and mains quality monitoring of all threephase loads, with or without neutral, supply voltage from 208VAC to 690VAC and frequencies from 50 to 400Hz.
It can be configured to monitor not only under/over voltage but also asymmetry between different phases voltages or the voltage tolerance.

- **Device configuration**

The relay operates when all the phases are present, the phase sequence is correct and the input voltage levels are within set limits.
Delay on alarm is configurable by front dials, each one of the two alarms (under/over or asymmetry/tolerance) can be set with individual delay.

Overvoltage / ASY adjustment dial	
Typology	Linear selection from 2% to 22%
Resolution	2% / notch
Function	Overvoltage or asymmetry percentage alarm setting

Undervoltage / tolerance adjustment dial	
Typology	Linear selection from -2% to -22% for undervoltage or ±2% to ±22% for tolerance
Resolution	2% / notch
Function	Undervoltage or tolerance percentage alarm setting

Alarm 1 delay setting dial	
Typology	Logarithmic adjustment from 0.1s to 30s
Resolution	From 100ms/notch at 0.1s to 10s/notch at 30s
Function	Delay on alarm 1, for overvoltage or asymmetry

Alarm 2 delay setting dial	
Typology	Logarithmic adjustment from 0.1s to 30s
Resolution	From 100ms/notch at 0.1s to 10s/notch at 30s
Function	Delay on alarm 2, for undervoltage or tolerance

DIP switches	
Typology	6 + 2 DIP Switches
Function	- Power ON Delay - Grid type - Grid voltage (11 ranges) - Output configuration - Operating function

- **Alarms**

The relays release immediately (<200ms), when an alarm goes off, in case of phase loss detection or wrong phase sequence.
Else it releases after the set "delay on alarm", in case of other, DPC01 possible configurable, events detection:
- Overvoltage
- Undervoltage
- Asymmetry excess
- Out of tolerance mains voltage

Overvoltage or asymmetry detection cause output 1 relay and LED 1 to turn OFF at the end of the set delay on alarm 1. During the delay elapsing the red "AL" LED blinks slowly and turn steady ON at the end of delay.
Undervoltage or out of tolerance detection cause output 2 relay and LED 2 to turn OFF at the end of the set delay on alarm 2. During the delay elapsing the red "AL" LED blinks slowly and turn steady ON at the end of delay.

- **Visual information**

DPC01DM44 feature 4 front LEDs which provide operation status information.
- LED 1, yellow, is ON when the output 1 relay is energised.
- LED 2, yellow, is ON when the output 2 relay is energised.
- LED "AL" provides Alarm Status information: when an over/under voltage or tolerance/asymmetry alarm is triggered, but there is a delay on alarm elapsing, the LED blinks red at 2Hz during the delay then, if alarm situation still present at the end of delay, it turns steady ON.
If a phase is lost or the phase sequence is wrong and the LED flashes fast at 5Hz.
- Bottom LED green, is ON when at least 2 phases are supplied.

- **Phase loss**

Phase loss measurement is performed by comparing the 3 phases voltages (L1-L2, L2-L3, L3-L1) or phase to neutral (L1-N, L2-N, L3-N) on star grid type. If the voltage of one phase falls below 70% compared to the other 2 phases, the alarm goes off. DPC01DM44 detects loads regenerated voltage, for instance on motor or transformer loads.

- **Asymmetry**

Asymmetry is an indicator of the mains quality and it is defined as the absolute value of the maximum deviation among the mains voltages, divided by the nominal voltage of the 3-phase system.
The definition changes according to the voltage reference:
1) in case of phase-phase voltages: (max |ΔVLL|/VNOM) *100
2) in case of phase-neutral voltages: (max |ΔVLN|/VNOM) *100

- **Tolerance**

Tolerance is another indicator of the mains quality and it is definied as the absolute value of the maximum deviation of the mains voltages from the nominal voltage, divided by the nominal voltage of the 3-phase system.
The definition changes according to the voltage reference:
1) in case of measuring phase-phase voltages: (max |VΔNOM - VLL| / VΔNOM)*100
2) in case of measuring phase-neutral voltages: (max |VNOM - VLN| / VNOM) * 100

Operating diagram

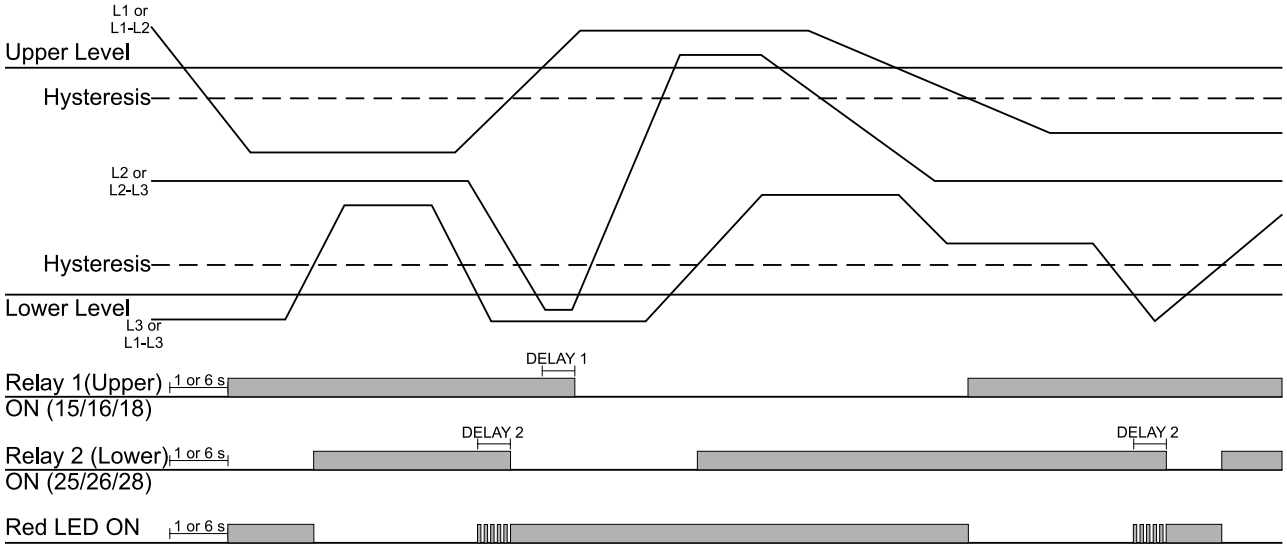


Fig. 2 *Over and undervoltage monitoring (2 x SPDT relays)*

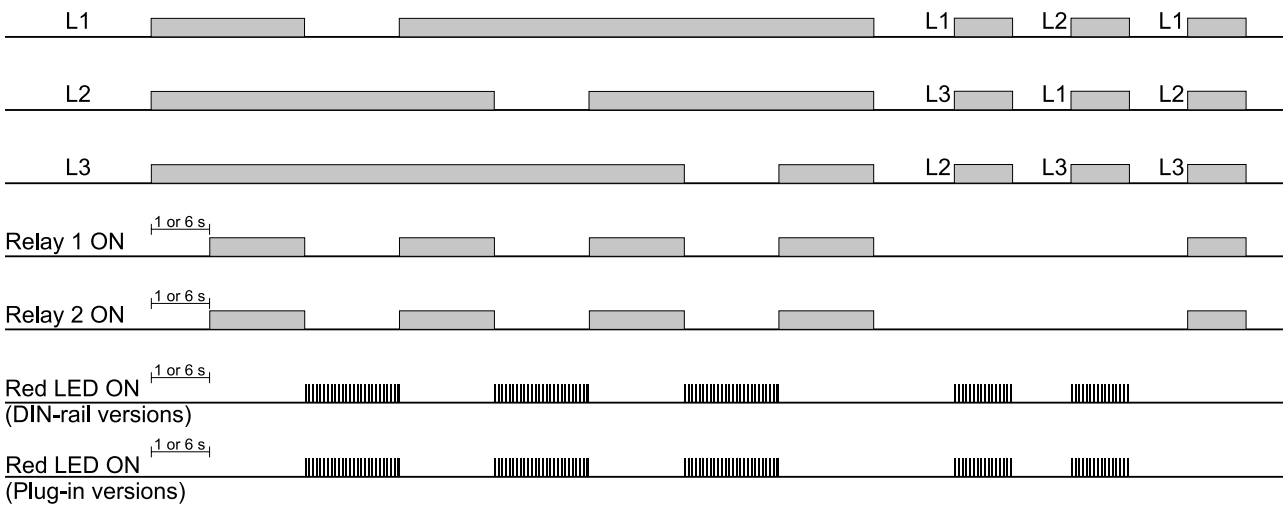


Fig. 3 *Phase sequence, total phase loss*

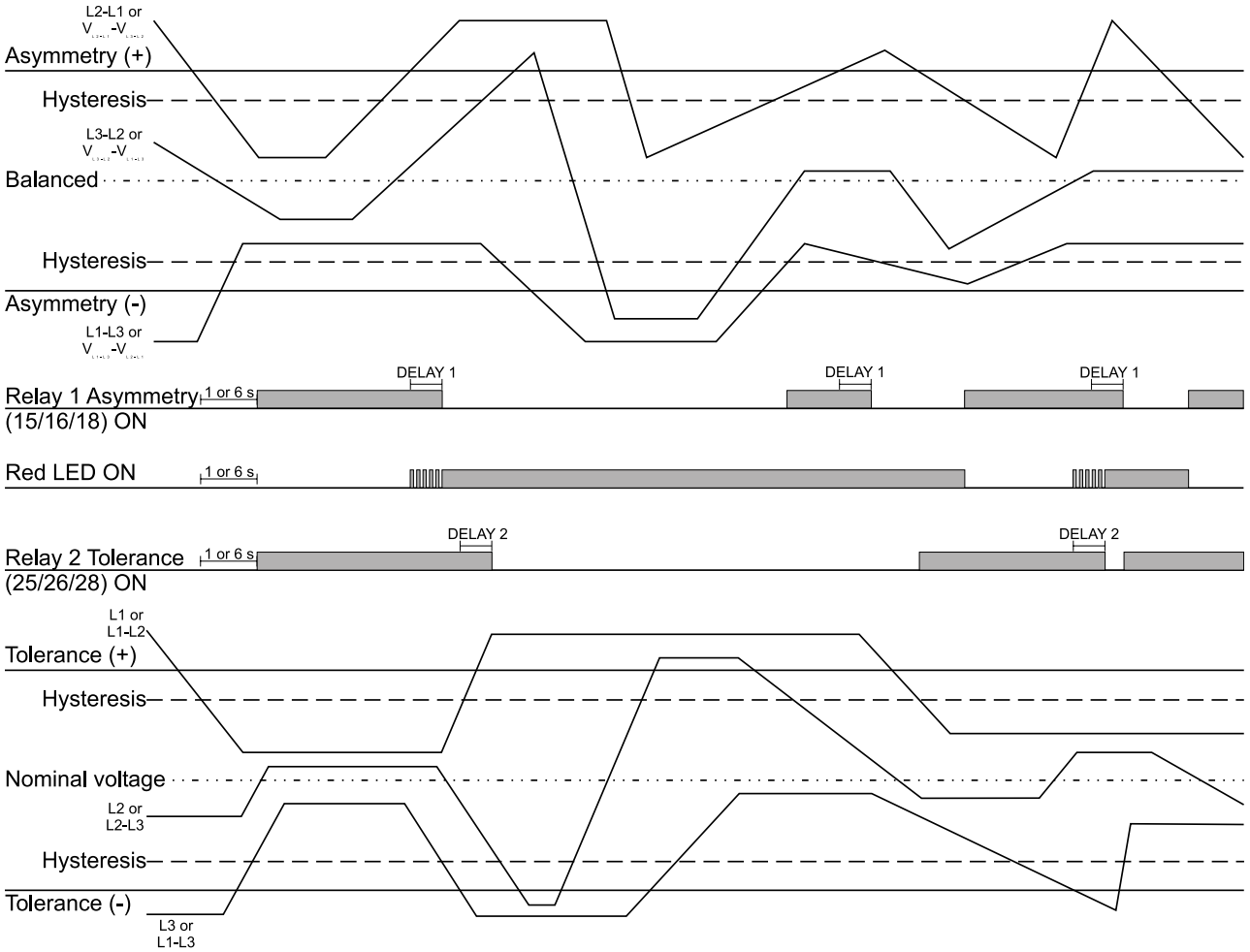


Fig. 4 *Asymmetry and tolerance monitoring (2 x SPDT relays)*

Connection Diagrams

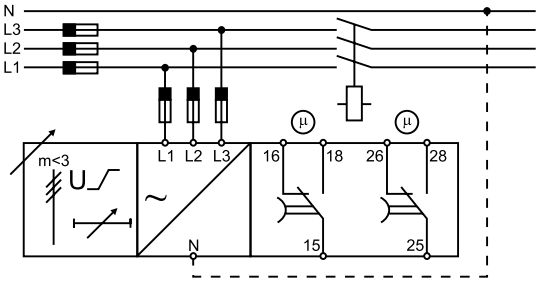


Fig. 5 *DPC01 - Example 1*

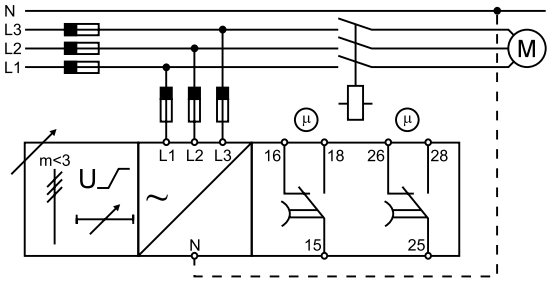


Fig. 6 *DPC01 - Example 2*

References

Order code

DPC01DM44

DPC02DM44

True RMS 3-Phase voltage and frequency monitoring relay

Benefits

- **Widest input voltage range and frequency.** Very wide input voltage range: from 208Vac to 690Vac ±15% (177Vac to 793Vac), both 50Hz and 60Hz.
- **Adjustable voltage ranges.** 11 voltage ranges can be selected by front DIP Switches.
- **Under/over voltage or frequency tolerance**. Voltage and frequency are both monitored at the same time.
- **Switch mode power supply.** Very low consumption, heat and dissipation. Control circuit power supply is filtered and therefore immune to mains disturbances, noise and harmonics.
- **Output LED indication.** One LED each output provides output status information.
- **2 relay contact outputs.** Two relay outputs provide electrical (remote) indication of the alarms/output status.
- **2 delays on alarm**. Two independent alarms for under/over voltage and frequency tolerance.

Description

DPC02DM44 relay is a multifunction threephase mains monitoring device.
Power supply is provided by the monitored mains, is wide input range and switch mode.
Consumption, dissipation and consequently heat are very limited.

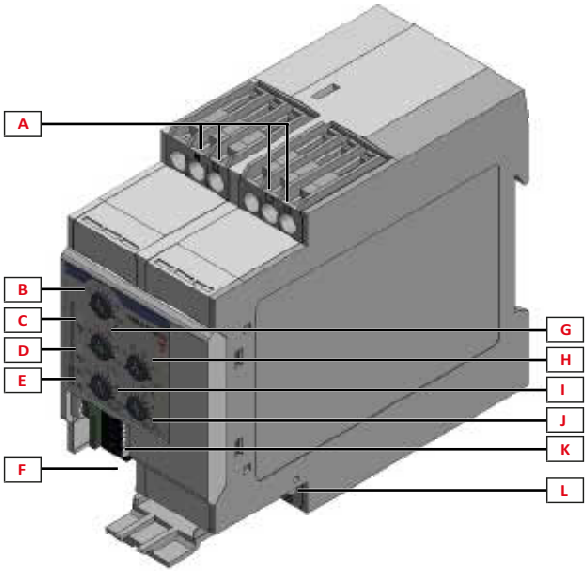
Applications

DPC02DM44 is suitable for applications where it is necessary to monitor, besides the phase presence and correct phase sequence of threephase mains, also the correct supply voltage and frequency: it is particularly suited for generators, either fuel powered or renewable energy ones, and on CHP systems. It is also indicated to monitor supply voltage of loads sensitive to frequency fluctuations and correct voltage.

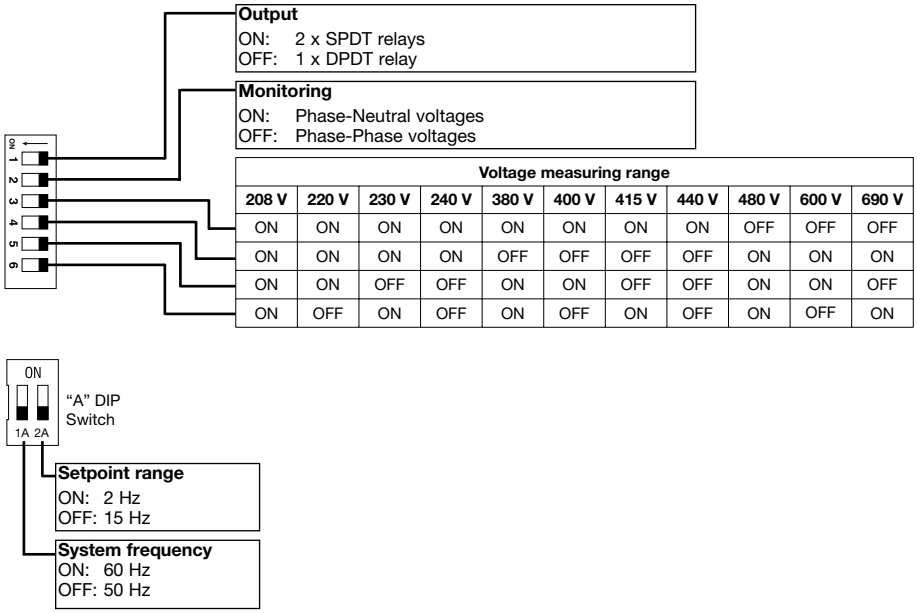
Main functions

- 3Ph or 3Ph+N monitoring
- From 208V to 690V @ 50 or 60Hz, nominal voltage and frequency
- Over / under voltage and frequency tolerance
- Phase sequence and phase loss alarm
- 2 x 8A SPDT relay outputs

Structure



Element	Component	Function
A	Input/supply terminals	L1, L2, L3 and N (when necessary), double cage clamp terminals
B	Alarm 1: Voltage	Overvoltage setting dial
C	Output status LED (2)	Yellow, ON when output 2 active (No Alarm)
D	Output status LED (1)	Yellow, ON when output 1 active (No Alarm)
E	Alarm "AL" and Power ON LED	Green in normally supplied conditions Red flashing or steady when an alarm condition is triggered
F	Output terminals (1)	Output 1 relay contacts terminals 15 COM, 16 NC*, 18 NO* * when power supply not applied.
G	Alarm 1: Voltage	Undervoltage setting dial
H	Alarm 2: Frequency	Frequency tolerance percentage setting dial
I	Delay on alarm 1	Delay on alarm 1 setting dial. Delay from 0.1s to 30s
J	Delay on alarm 2	Delay on alarm 2 setting dial. Delay from 0.1s to 30s
K	DIP switches	See fig. 1 (DIP switch settings table)
L	Output terminals (2)	Output 2 relay contacts terminals 25 COM, 26 NC*, 28 NO* * when power supply not applied.



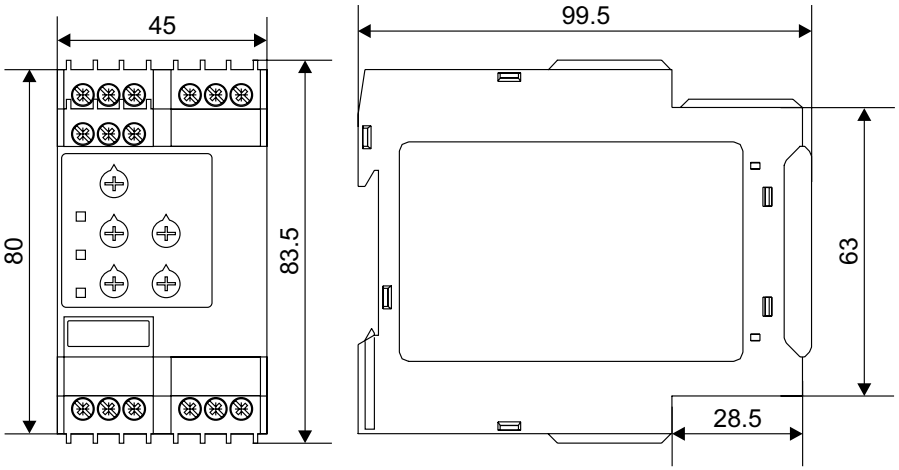
Voltage measuring range										
208 V	220 V	230 V	240 V	380 V	400 V	415 V	440 V	480 V	600 V	690 V
ON	ON	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF
ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON
ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF
ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON

Fig. 1 *DIP switch settings table*

Features

General

Material	PA66 or Noryl
Colour	RAL7035 (light grey)
Dimensions d x h x w	99.5mm x 80mm x 45mm (3.92" x 3.15" x 1.77")
Protection degree	IP20
Weight	220 g (7.76oz)
Terminals	Cable size from 0.05mm² to 2.5mm² (AWG30 to AWG13), stranded or solid
Tightening torque	Max. 0.5Nm (4.425lb.in)
Terminal type	Double cage screw terminals



Power supply

Power supply	Voltage range: 208Vac to 690Vac ±15% (177V to 793V) Supplied from measured phases Frequency range: 50Hz or 60Hz ±10% sinusoidal waveform
Consumption	< 4.5 VA
Supply technology	Switch mode supply from all 3 phases

Environmental

Working temperature	-20° C to 60° C (-4° F to 140° F)
Storage temperature	-30° C to 80° C (-22° F to 176° F)
Relative humidity	5-95% non condensing
Pollution degree	2
Operating max altitude	2000 m amsl (6560ft)
Salinity	No saline environment
UV resistance	No

Vibration/Shock resistance

Test condition	Test	Level
Tests with unpacked device	Vibration response (IEC60255-21-1)	Class 1
	Vibration endurance (IEC 60255-21-1)	Class 1
	Shock (IEC 60255-21-2)	Class 1
	Bump (IEC 60255-21-2)	Class 1
Tests with packed device	Vibration random (IEC60068-2-64)	Class 1
	Shock (IEC 60255-21-2)	Class 1
	Bump (IEC 60255-21-2)	Class 1

Class 1: Monitoring devices for normal use in power plants, substations and industrial plants and for normal transportation conditions.
The packaging type is designed and implemented in such manner that the severity class parameters will not be exceeded during transportation.

Compatibility and conformity

CE-marking	According to EN 60947-5-1. Complies to European LV directive 2014/35/EU and EMC directive 2014/30/EU: Immunity according to EN61000-6-2; Emissions according to EN61000-6-3
Approvals	c UL us LISTED UL508, CSA Standard C22.2 CCC, RINA

Inputs

Measuring ranges	
Measured variables	Voltage and frequency PH-PH measurement on L1, L2 and L3 lines Phase sequence Phase loss

Voltage measurement	
Typology	PH-PH voltage measurement on L1, L2 and L3 lines
Nominal line range	From 208Vac to 690Vac ±15%
Setting ranges (Un)	208V, 220V, 230V, 240V, 380V, 400V, 415V, 440V, 480V, 600V, 690V

Frequency measurement	
Typology	PH-PH or PH-N frequency measurement on L1, L2, L3 and N (when connected)
Nominal line range	50 to 60Hz ±10%
Setting ranges	2Hz or 15Hz

Over / under voltage alarms	
Input variables	Voltage measurements L1-L2, L2-L3, L1-L3 or L1-N, L2-N, L3-N when star mains is selected
Reaction time	≤ 200ms + set delay on Alarm
Undervoltage setting range (U<)	From -2% to -22%
Overvoltage setting range (U>)	From 2% to 22%
Resolution	1V + 2% notch
Accuracy	1V + 2%
Repeatability	0.5% reading
Hysteresis	Setpoint between 2% and 5% = Hys 1% Setpoint between 5% and 22% = Hys 2%
Delay ON	Adjustable from 0.1s to 30s Accuracy: absolute form ±50ms at 0.1s to ±5s at 30s Repeatability: absolute form ±10ms at 0.1s to ±1 at 30s
Delay OFF	None

Frequency tolerance alarm	
Input variables	Frequency measurements L1-L2, L2-L3, L1-L3 or L1-N, L2-N, L3-N when star mains is selected
Reaction time	≤ 200ms + set delay on alarm
Frequency tolerance setting range	From 10% to 110%
Hysteresis	2Hz range: 0.05Hz 15Hz range: 0.025Hz
Delay ON	Adjustable from 0.1s to 30s Accuracy: absolute form ±50ms at 0.1s to ±5s at 30s Repeatability: absolute form ±10ms at 0.1s to ±1 at 30s
Delay OFF	None

Phase loss alarm	
Input variables	Voltage measurements L1-L2, L2-L3, L1-L3 or L1-N, L2-N, L3-N when star mains is selected
Alarm Threshold	≤70% of the least one compared to rated value
Restore threshold	>70% of least phase compared to rated value + Hysteresis
Reaction time	≤ 200 ms
Hysteresis	2% fixed
Delay ON	None
Delay OFF	None

Phase sequence alarm	
Input variables	Connection L1, L2, L3
Reaction time	≤ 200 ms
Adjustable range	Not applicable, always active
Delay ON	None
Delay OFF	None

Outputs

Number of outputs	2
Type	SPDT electromechanical relay with change-over contacts
Logic	Output de-energized on alarm
Contact rating	**AC1**: 8 A @ 250 VAC **AC15**: 2.5 A @ 250 VAC **DC12**: 5 A @ 24 VDC **DC13**: 2.5 A @ 24 VDC
Electrical lifetime	10^5 operations
Mechanical lifetime	>30 x 10^6 operations
Assignment	According to DIP 2A setting: Output 1: over / under voltage Output 2: frequency tolerance

Insulation

Terminals	**Basic insulation**
Inputs: L1,L2,L3,N to Output : 11,12,14	≥ 2kVac (rms), 4KV impulse 1.2/50us (basic)

Operating Description

- **Suitability**

DPC02DM44 can be used for supply quality monitoring of three phase loads and generators, with or without neutral, supply voltage from 208VAC to 690VAC and frequency 50 or 60Hz.
It can be configured to monitor, together with voltage, also mains frequency stability with a precision, depending upon setting, from ± 0.2Hz to ± 2.2Hz or from ± 1.5Hz to ± 16.5Hz.

- **Device configuration**

The relay operates when all the phases are present, the phase sequence is correct and the input voltage and frequency levels are within set limits.
Delay on alarm is configurable by front dials, each one of the two alarms (under/over or frequency) can be set with individual delay.

Overvoltage adjustment dial	
Typology	Linear selection from 2% to 22%
Resolution	2% / notch
Function	Overvoltage percentage alarm setting

Undervoltage adjustment dial	
Typology	Linear selection from -2% to -22%
Resolution	2% / notch
Function	Undervoltage percentage alarm setting

Frequency tolerance adjustment dial	
Typology	Linear selection from 10% to 110% of tolerance
Resolution	10% / notch
Function	Fine adjustment of frequency tolerance on the range selected by DIP Switches
Adjustable tolerance range	with DIP 2A ON: ± 0.2Hz to ± 2.2Hz with DIP 2A OFF: ± 1.5Hz to ± 16.5Hz

Alarm 1 delay setting dial	
Typology	Logarithmic adjustment from 0.1s to 30s
Resolution	From 100ms/notch at 0.1s to 10s/notch at 30s
Function	Delay on alarm 1, for voltage

Alarm 2 delay setting dial	
Typology	Logarithmic adjustment from 0.1s to 30s
Resolution	From 100ms/notch at 0.1s to 10s/notch at 30s
Function	Delay on alarm 2, for frequency

DIP switches	
Typology	6 + 2 DIP Switches
Function	- Output configuration - Grid type - Grid voltage (11 ranges) - System frequency - Tolerance range selection

- **Alarms**

The relays release immediately (<200ms), when an alarm goes off, in case of phase loss detection or wrong phase sequence.
Else it releases after the set "delay on alarm", in case of other, DPC02 possible configurable, events detection:
- Overvoltage
- Undervoltage
- Frequency out of tolerance

Overvoltage or undervoltage detection cause output 1 relay and LED 1 to turn OFF at the end of the set delay on alarm 1. During the delay elapsing the red "AL" LED blinks slowly and turn steady ON at the end of delay.
Frequency or out of tolerance detection cause output 2 relay and LED 2 to turn OFF at the end of the set delay on alarm 2. During the delay elapsing the red "AL" LED blinks slowly and turn steady ON at the end of delay.

- **Visual information**

DPC02DM44 feature 3 front LEDs which provide operation status information.
- LED 1, yellow, is ON when the output 1 relay is energised.
- LED 2, yellow, is ON when the output 2 relay is energised.
- LED "AL" provides POWER and ALARM status information: Green when powered on at least two phases and no alarms are present. When an over/under voltage or freqency alarm is triggered, but there is a delay on alarm elapsing, the LED blinks red at 2Hz during the delay then, if alarm situation still present at the end of delay, it turns steady ON.

If a phase is lost or the phase sequence is wrong and the LED flashes fast at 5Hz.

- **Phase loss**

Phase loss measurement is performed by comparing the 3 phases voltages (L1-L2, L2-L3, L3-L1) or phase to neutral (L1-N, L2-N, L3-N) on star grid type. If the voltage of one phase falls below 70% compared to the other 2 phases, the alarm goes off. DPC02DM44 detects loads regenerated voltage, for instance on motor or transformer loads.

Operating diagram

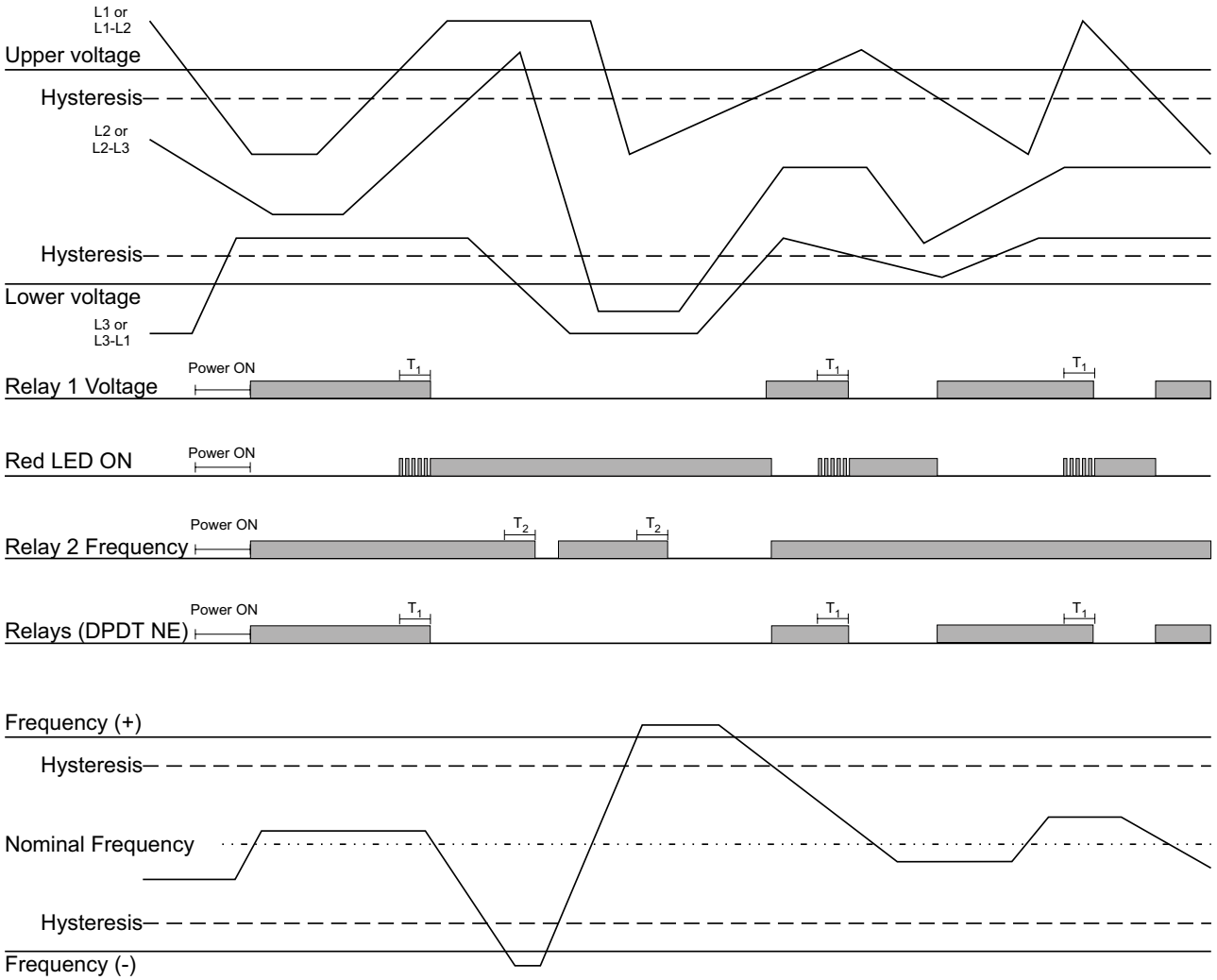


Fig. 2 *Over/under voltage and over/under frequency monitoring (2 x SPDT relays)*

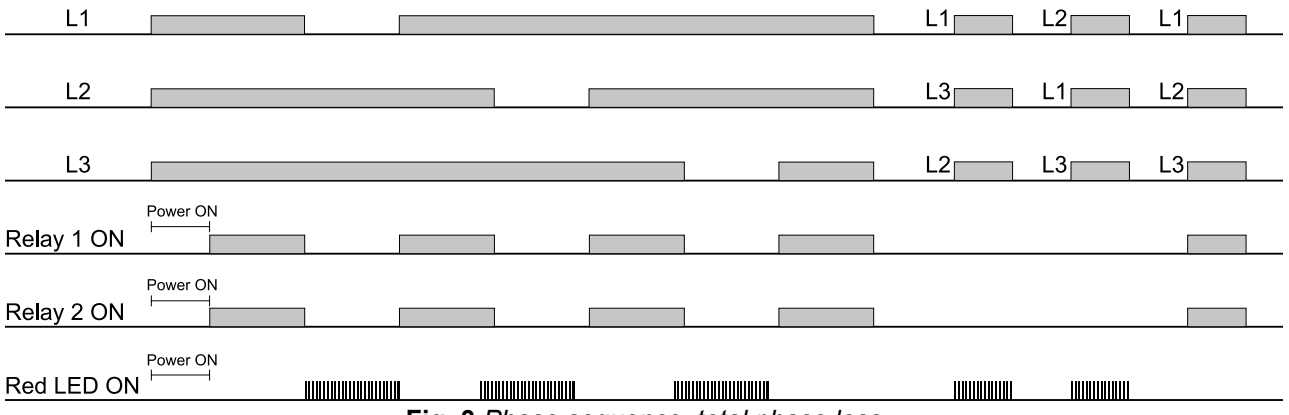


Fig. 3 *Phase sequence, total phase loss*

Connection Diagrams

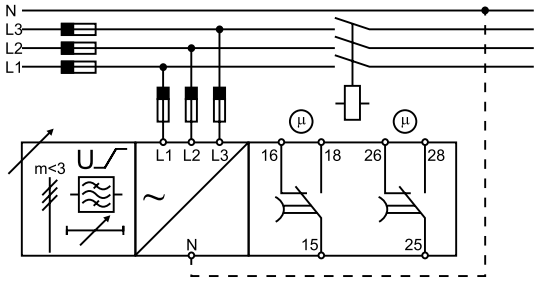


Fig. 4 *DPC02 - Example 1*

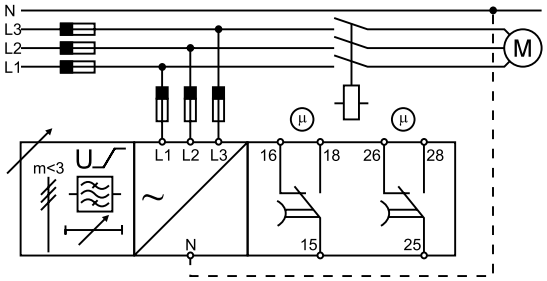


Fig. 5 *DPC02 - Example 2*

References

Order code

DPC02DM44